Flora W. Patterson
Compliments of
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Diseases of Melons and Cucumbers

During 1903 and 1904.

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[The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon written application. Address, Director of Agricultural Experiment Station, Morgantown, W. Va.]

are known to cause diseases of considerable importance to melons and cucumbers.

THE CAUSE OF THE BLIGHT.

Not being satisfied with the information that I had been able to obtain by means of correspondence and personal interviews with some of the growers, and the few specimens of diseased leaves, I visited a number of the melon and cucumber fields in the vicinity of Arroyo, Wellsburg, Point Pleasant, Elwell and Mercer's Bottom, some of them only once, others at intervals of about a month. At these several places and intermediate points I collected specimens and took notes on the diseases of melons and cucumbers. On the specimens collected I have found several species of fungi attacking both the vines and the fruits. I am indebted to the growers whom I met for their kind treatment and valuable information, especially to Mr. H. C. Brenneman of Arroyo, Mr. S. C. Gist of Wellsburg, Mr. R. L. Hutchinson of Point Pleasant and Mr. C. S. Kline of Elwell.

The following are a few of the more important diseases of melons and cucumbers caused by parasitic fungi, one of which has been studied to a considerable extent.

Leaf-Spot (*Cercospora citrullina* Cooke). This disease was very abundant in fields of watermelon at Point Pleasant and Elwell. It will be worth investigation another year on account of the injury done to the foliage. Small black spots, nearly circular in outline, and with a grayish center, occur on the leaves. These spots are about one-eighth of an inch in diameter, some being somewhat larger. Under a hand-lens, the grayish center of the spots is seen to contain short black filaments with tufts of slender light colored bodies on their summits, the spores of the fungus which can bring about an infection of the leaves on the same or other vines. The spots appear first on the leaves at the center of the hill, gradually spreading over the entire hill. The diseased leaves become dry and broken, and are finally scattered about by the wind. Another species of *Cercospora* was found on cucumber leaves, but not in sufficient amount to be injurious to any extent.

Downy Mildew (*Plasmopara Cubensis* (B. & C.) Hum-

Leaf Mold or Blight of Muskmelon. Natural size.
From photograph by W. E. Rumsey.

phrey). Some muskmelon leaves sent in from Elm Grove had downy mildew on them. I also found the same fungus on leaves of cucumber at Elwell. Before I had visited the melon fields, I thought that the downy mildew was the probable cause of the general blighting of the melons. The downy mildew makes its appearance as frost-like patches on the under side of the leaves, due to the fungus growing out through the stomata in order to mature and distribute its spores. It produces yellowish-brown spots on the upper side of the leaves. The frost-like spots gradually take on a violet color as the spores mature. It has not been determined yet how the fungus passes the winter. This is a difficult disease to combat during damp weather, the spores germinating very soon when they come in contact with water. Bordeaux mixture has been used with varying success in other states for controlling the disease. Spraying should be begun early, at about the time the vines begin to run, otherwise it will be of little value.

Leaf-Mold or Blight (*Alternaria Brassicae* var. *nigrescens* Pegl.) The fungus which causes this disease produces yellowish-brown spots on the leaves of the muskmelon and cucumber, similar to those produced by the downy mildew in color, but usually thicker, and with more or less distinct wavy markings. There was scarcely a garden or field containing muskmelons which I visited where I did not find this disease. A field of muskmelons, where the fungus was very destructive, had a few hills of cucumbers. In other fields where there were a few hills of muskmelons among cucumbers, the disease was found on the muskmelons. The injury done to the cucumbers was in all cases slight.

One grower, in order to get an early crop of muskmelons, started enough plants on sod to make one hundred hills when transplanted in the field. These plants were badly infected about August first, while others that had been planted around the one-hundred-hill strip were free from the disease. By the first of September the disease had spread over the entire field, and the plants that had been set out were nearly all dead, the conditions having been favorable for the distribution of the disease. Upon inquiry from a number of growers, I learned that while the yield is considerably lessened by the disease, the quality of the muskmelon

is so poor, especially of the last to ripen, and they are practically worthless. This disease can be controlled to a considerable extent by spraying. As a means of prevention, it is not advisable to plant muskmelons on the same ground the second year. Whether this disease will become as injurious to the cucumber, in the vicinity of Point Pleasant where cucumbers are grown for pickles, remains to be determined.

Damping-off. Mr. Fred E. Brooks, special agent for the Experiment Station, brought me some cucumber seedlings that had damped-off, with the report that a considerable number in this particular field had died in the same way. One plant in a hill would tip over and the others would soon follow. The plants which he brought me were placed in a moist-chamber and a species of *Fusarium* developed from them in a few days. To test whether the *Fusarium* was the cause of the damping-off, or only a chance infection of the dead plants, seeds of cucumber, muskmelon, watermelon and pumpkin were kept moist until some of them had begun to show signs of germination, when they were mixed with small pieces of the seedlings that had damped-off and the seeds then planted in five-inch pots in the greenhouse. Check pots of untreated seeds were planted first, so as to avoid the possibility of infecting the seeds after handling those that had been treated, and to determine whether the plants in these pots would damp-off from some fungus that might happen in the soil. Both sets received the same care after planting. The results obtained from the treated seeds are given in the following table :

No. of Pots.	Kind of Seeds.	Damped off.
2	Cucumber.....	5
1	Muskmelon ...	8
1	Watermelon...	1
1	Pumpkin.....	....

Some of the seedlings began to show signs of dying before they had pushed their seed-leaves above ground Others came up and seemed healthy for a few days, then began to look watery at the surface of the ground, the stem began to shrivel and become smaller and smaller, finally the whole plant wilted and fell over to

one side. None of the plants damped-off in the check po s, although the seeds did not germinate as well as those that had begun to germinate when they were planted. From the above, it would seem that the *Fusarium* was the cause of the damping-off. There is a possibility that the fungus was present on the cucumber seeds when they were planted in the field, or it may have been in the soil when the seeds were planted and found its way into the seedlings. Damping-off cannot be very well prevented in the field if the weather happens to be warm and the soil is rather moist, and if the fungi which produce damping-off are present. In the greenhouse, it may be prevented by sterilizing the soil.

A species of *Fusarium* was found attacking cucumber vines at Point Pleasant. It was confined to those portions of the vines where they had been twisted and broken, apparently by the wind. The fungus showed on the wounds as masses of pink spores. The part of the plant beyond the injury was wilted.

Bacteria were found in the fibro-vascular bundles of a few wilted cucumbers. When the vines were cut crosswise, the bacteria oozed out as a white gummy mass.

Anthracnose (*Colletotrichum lagenarium* (Pass.) Ellis & Halsted). This has been the most destructive disease of the watermelon during 1904. It was found alone and accompanied by the leaf spot in a large number of the fields visited. It should be noted that the disease was worse, as might be expected, where watermelons had been grown on the same ground the previous year or had been grown on ground close by. In some instances the spread of the disease could be traced directly to an old field. It is not advisable, then, to plant watermelons two years in succession on the same ground if the disease was present the first year. In some fields there were indications that the disease might have remained two years. The fungus which causes the disease produces angular black spots on the leaves, and elongated black spots with light colored centers on the petioles of the leaves and vines. When the petioles of the leaves and the vines are attacked, the part attacked gradually shrivels and the portion of the leaf and vine above wilts and dies. The small fruits are sometimes killed. Black spots appear on them, the small melons in some instances turning black and dropping off. When the fungus does not kill the small melons they do not develop on the side at-

tacked by the fungus. (Plate I, fig. 1). On the larger and more mature watermelons, ulcer-like cavities of various sizes are formed, the anthraces, (or as they are sometimes called, the anthracnoses) occasionally as much as two inches in diameter and nearly an inch deep. (Plate II). The cavities usually have a black border and are covered with gummy masses of pink spores, that ooze through the rind. (Plate I, fig. 2). Under a hand-lens, small black spines may be seen around the masses of spores, especially in the black spots on the leaves. Beneath the cavities, the rind is thickened and separated from the pulp. If bacteria and other fungi get into the cavities, as they often do, the melons rot on the vines. I collected the same fungus on leaves of muskmelon at Arroyo, and on leaves of cucumber at Elwell. The spots on the leaves of muskmelon and cucumber are not black, as they are on the watermelon, but brown.

Cultures of the Fungus. The first really good specimen of the fungus that I collected was from a slice of watermelon that I had at a hotel where I happened to be for dinner. After eating out the "heart," I wrapped a piece of the rind in my handkerchief and carried it to the laboratory. Whether this piece of watermelon was a West Virginia product or not, I cannot say, but it has served my purpose well. If I had waited I could have obtained an abundance of similar material, for there was displayed on the streets of Morgantown, at two different times, large numbers of watermelons so completely covered with the anthracnose that the fruit dealers offered to sell them at almost any price to get rid of them. One of the lots of watermelons was probably from Indiana, judging from the name and address of some person carved on one of the melons. This certainly was not a very good way to advertise Indiana watermelons. (See Plate II).

From the piece of watermelon picked up at the hotel, I at once proceeded to obtain pure cultures. Many generations of the fungus have been grown during the year that I have been studying its life-history. Pure cultures were obtained by means of poured plates of muskmelon-agar, and by planting the spores on the surface of agar with a sterile platinum needle. The latter method gave as good results and required less time, although, from a scientific standpoint, it would not be considered as accurate. With a little care in sterilizing the needle and in picking up the spores

the majority of the plantings were pure. The plantings that were pure and some from the poured plates were transferred to tubes of muskmelon-agar or to plates of the same medium. After the fungus had produced spores, it was an easy matter to continue the cultures.

Germination of the Spores. Although the spores are pink when in masses, they are colorless when seen singly with the microscope; they are oblong in shape and about 20x6 microns in size. The shape and size, however, vary to some extent. (Plate III, fig. 1). By means of plantings made on drop cultures of muskmelon-agar, I was able to watch the development of the fungus from the time the spores were planted until another generation of spores was produced. The spore contents are granular at first, (Plate III, fig. 1, *a*), but they become vacuolated in the process of germination. (Plate III, fig. 1, *b*).

Development of the Mycelium. One or more germ tubes may develop from a spore at the time of germination, the mycelium soon becoming septated and branched (Plate III, fig. 2–4). The mycelium at first is colorless, or white, when seen developing on the surface of the culture medium. After a while the older filaments begin to turn brown when viewed by transmitted light but appearing black otherwise. From some of the filaments setae are developed. They are colorless at first and cannot be distinguished from the other filaments. They finally become sharp-pointed and colored brown from the terminal cell backward. The older setae are so dark colored as to appear black.

Plates of muskmelon-agar were prepared and melted paraffin poured over the surface, the layer of paraffin wholly or only partially covering the agar. With a sterile needle, spores were introduced through the layer of paraffin into the agar beneath, the opening in the paraffin being afterward closed with a hot needle. The spores germinated as well as they did when exposed to the air, and there was no appreciable difference in the development of the mycelium. However, the fungus did not form any spores until after the mycelium reached the edge of the paraffin layer. After eighteen days the mycelium penetrated the paraffin layer and then spores were formed on the surface. The growth of the fungus beneath the paraffin layer suggests that it can exist as a facultative anærobe

The fungus made a vigorous growth in flasks of cornmeal containing a small amount of muskmelon-agar, and in similar flasks of cornmeal mush. A thick layer of filaments formed on the surface of these media, gradually extending into the media as the water was used or evaporated. This surface growth was at first white and downy, then pink papillæ formed on the surface, the papillæ turning black and masses of pink spores appearing. These elevations, or papillæ, were much more prominent on the cornmeal media than they were on the muskmelon-agar. On pea-agar and apple-agar there was a fairly good growth, but no spores were formed in the few cultures made on these media.

Formation of Chlamydospores. Under favorable conditions, there was a rapid and abundant growth of mycelium, but when the spores were placed in water or had only a small amount of available food, as in drop cultures, brown bodies of several shapes and resembling chlamydospores were produced. (Plate III, fig. 5, *a*). Whether these bodies were really chlamydospores or not I have not yet determined. They were for the most part terminal and of a uniform brown color, the color sometimes extending back into the filament, (Plate III, fig. 5, *b*), and containing one or more vacuoles.

Formation of Conidiospores. The papillæ that developed on the surface of the various media, when teased out of the mycelium, proved to be sclerotia-like bodies composed of a mass of two distinct types of filaments, one colorless, the other brown. These sclerotia-like bodies were either simple or compound in structure, that is, they were composed of one or more spore-bearing parts (acervuli). Where these could be watched in their development, as on the surface of agar in Petri dishes and drop cultures, it was found that one acervulus was formed, (Plate IV, fig. 1), others afterwards developing about it. Microtome sections of the sclerotia-like bodies showed that they were spherical at first, with a central layer of radiating hyphæ, surrounded by a layer of brown filaments. The layer of hyphæ in the center resembled a cross-section through a pycnidium at about the time the spores are beginning to form on the basidia. Scattered through the layer of hyphæ was an occasional seta that had its origin in the brown layer of filaments. In the more advanced stages of development, an opening was made in the outer layer,

through which the hyphæ projected and on which spores were formed, the breaking apart of the sclerotia-like body seeming to have been caused by the pressure of the hyphæ from within and away from the substratum on which the bodies were growing. After these bodies had been broken open, there was a tendency to form a horizontal layer of interwoven filaments supporting a layer of erect hyphæ (basidia) bearing spores in different stages of maturity. (Plate III, fig. 6, *a*). Among the basidia were a few setæ. (Plate III, fig. 6, *b*).

A vertical section through an acervulus indicated that the basidia and setæ were born from the surface of a layer of cells resembling parenchymatous tissue, (Plate III, fig. 6, *c*), but such was not the case, for when a portion of an acervulus was "teased" apart it was found that this layer was composed of a mass of filaments which gave rise to basidia. (Plate IV, fig. 2). A spore was formed by the gradual enlargement of the end of a basidum, from which it was finally abstricted. (Plate IV, fig. 3, *a*). The spores were enveloped in a viscid substance. Whether this substance serves to protect the spores from drying out, or whether it serves as a means for the distribution of the spores by attaching them to insects or other parts of the same or different plants, has not been determined. It has been determined that the spores retain their vitality for months when they are kept dry, while in a moist atmosphere they germinate *in situ*, forming a white tuft of filaments, as may be seen on the melons during damp weather or in old cultures kept where it it damp. The ability of the spores to retain their vitality for some considerable time when they are dry may serve as an explanation for the distribution of the disease by means of infected seeds. If the spores become attached to the seeds, as they are liable to if the seeds are saved from diseased melons, the conditions that would favor the germination of the seeds would be favorable for the germination of the spores. The seeds of melons are so sticky that the spores would become attached to them, even if the spores themselves were not sticky.

No one, in so far as I know, has found out how the fungus survives the winter and brings about infection the following summer. The autumn rains would be apt to cause the germination of the mature spores. Whether a mycelium can develop and live

in the soil I have not determined. If the bodies which resemble chlamydospores are really chlamydospores, it is possible that they represent the winter stage of the fungus. There are myriads of acervuli in various stages of development in the pieces of leaves, vines and melons scattered about the field. When it rains, so that these pieces are soaked up, there is a possibility that the spores continue to develop. There is probably some nutritious matter left in the pieces of melons sufficient to develop a few spores. These spores under proper conditions would infect the young melon plants and thus continue the disease. It is well known that the "mummied" plums, caused by the brown-rot fungus, harbor the fungus during the winter and are a source of infection the next year. I have been able to develop spores from such plums after they were two years old, and to have the spores germinate. Possibly the melon anthracnose spores may develop in much the same way from the melons that have been left in the field It is well worth determining how the anthracnose does pass the winter and bring about infection the following summer.

As to how the anthracnose gets established in a field would be a difficult matter to determine. There is a possibility that the spores were introduced on the seed, that some were carried from one field to another by insects, or that leaves may have been blown from a neighboring field. If diseased melons are purchased in the market and taken home. they may be the means of introducing the disease.

Experiments in Inoculation. As a means for determining whether the fungus causing the disease known as anthracnose of the watermelon is able to produce an anthracnose of other plants, a series of inoculations was made both from spores taken directly from the rinds of watermelons and from pure cultures of the spores grown on various artificial media. The spores from the pure cultures were originally obtained from the piece of watermelon rind picked up at the hotel, to which reference has previously been made.

The plants inoculated were grown in the greenhouse, with the exception of one set of beans. It has been found from trial with other plants, that inoculations made the latter part of the afternoon have been more successful than those made at other times The reason for this seems to be on account of the lower tempera-

ture in the greenhouse at night preventing an evaporating of the water used in making the inoculations from the plants, so that the spores have sufficient time to germinate and the promycelia to enter the tissues of the plant. To inoculate the plants, they were first sprayed with an atomizer until they were covered with small drops of water resembling dew-drops. Spores were then placed in the drops with a small cambric needle inserted in a handle, or a platinum needle was used. The needles were sterilized before each inoculation. After the plants had been inoculated they were covered with a bell-jar for from thirty-six to forty hours. When the temperature in the greenhouse was high at the time the inoculations were made, the bell-jars were sprayed with the hose in order to cool them and condense the moisture inside. The bell-jars were then covered with paper to prevent the sun from scalding the plants. Inoculations on the fruits were made by inserting some of the spores into the fruit with a sharp sterile needle. If the fruit had been picked from the plant, it was placed under a hand-glass to prevent drying out and to keep fruit flies from depositing their eggs in it. Those on the plants were not protected in any way. The following table will show the inoculations made and the results obtained:

Plants Inoculated.	Age of Plants.	Source of Spores.	Result.
Muskmelon	Seedlings	Watermelon fruit	Successful.
Cucumber	In blossom	" "	"
Wax Bean	Seedlings	Pure cultures	Failure.
" "	In blossom	" "	"
" "	Fruits (on plants)	" "	"
Cucumber	Fruits (picked)	" "	Successful.
Gourd	Seedlings	" "	"
Watermelon	"	" "	"
Muskmelon	"	" "	"
Pumpkin	"	" "	Failure.
Squash	"	" "	"
Wax Bean	"	" "	Doubtful.
" "	In blossom	" "	"
Watermelon	Fruits (on plants)	Watermelon fruit	Successful.
Cucumber	" " "	" "	"
Muskmelon	" " "	" "	"
Squash	" " "	" "	Doubtful.

When successful inoculations were obtained on seedlings, as melon, cucumber and gourd, spots were produced on the seed-leaves, (Plate V, fig. 2), after which depressions were formed and the seed-leaves began to dry up. When the inoculations were made on the stems, they became shrunken at the point of infection, and the upper portion of the plants fell over to one side, in

the same way that plants do that damp-off. (Plate V, fig 3). When infection takes place on the stems, the seedlings do in reality damp-off. The seedlings usually lived but a few days after the infection began to show on the stems. When it was on the seed-leaves, sometimes the plant was killed and sometimes only the seed leaves, the true leaves developing slowly. At best those plants that recovered were of little account and did not make strong plants.

Wax beans, which are very susceptible to the attack of the bean anthracnose, were inoculated at different stages of growth, in an attempt to determine, if possible, whether the anthracnoses of beans and melons are identical. Considerable work along this line has already been done at the New Jersey and Delaware Experiment Stations, but the results obtained, while indicative, do not seem conclusive. Brown spots resembling those of the anthracnose of the bean were very conspicuous on some of the seedling beans inoculated, but I was unable to find any spores in these spots. In a short time similar spots were noticed on the stems and leaves of some older plants which had been inoculated. However, no spores were found in these spots. Somewhat later spores were found in spots on the small beans, both on plants that had been inoculated and those that had not, but growing beside some melons and gourds that had been killed by the anthracnose. It is, therefore, not safe to conclude from these results that the anthracnose on the beans was the same as that on the melons and gourds. If it was, the appearance of the anthracnose on the bean plants that were not inoculated can be accounted for in that the spores that brought about the infection were transferred to them in watering the plants with the hose. There is a possibility that there were spores on the beans when they were planted, or that there were some in the soil. Inoculations made in the same way on a set of plants in the laboratory failed to develop the anthracnose. Spores were introduced into the stems of some of these plants and placed on the young bean pods. The plants were then kept moist for two days without obtaining any indication of the anthracnose. Inoculations will be continued, using seeds and soils that have been sterilized. The failure to obtain results from the inoculations on beans cannot be due to the lack of vitality of

the spores, for inoculations made with spores taken from the same cultures gave good results on melons.

Prevention and Control. Since the anthracnose is so prevalent and destructive in the melon fields of West Virginia, what can be, and has been, done to get rid of it? An attempt to eradicate it is out of the question. The next best thing will be to control it, and better still to prevent it. An attempt to control a disease when once it has become established is usually expensive. It was determined by observations made in the fields of the Ohio valley that the disease was worse in those fields where melons had been grown in previous years and where the disease was known to have been present. It would seem advisable, then, and it is being practiced by some growers, not to grow watermelons, muskmelons and cucumbers on ground where either of these crops have been grown the year before, but to rotate with such crops as wheat, corn, cowpeas, or clover, in order to let the fungus die out for want of the necessary host plant on which to grow.

A field of about an acre, on the farm of Mr. S. W. Moore at Elwell, was selected by the Experiment Station to test the value of sprays for controlling the disease. The field was divided into five blocks, each block consisting of sixty-three hills. The first, third and fifth blocks were sprayed with soda-bordeaux, normal-bordeaux and ammoniacal-copper-carbonate, respectively. The second and fourth blocks were used as checks and not sprayed. Mr. Fred E. Brooks, who had charge of the work, has furnished me the following data with reference to the crops previously grown on the field and the presence of the anthracnose :

"The site selected was a part of a field in which melons had been grown for two previous seasons, the vines of the first crop, that of 1902, having been comparatively free from disease and the yield of good melons heavy, but that of 1903, almost entirely destroyed before the melons were mature by anthracnose, the melons being of inferior quality and the yield light."

From this statement it will be seen that the disease increased from 1902 to 1903, and this year (1904), on the portions of the field where there was no spraying done the vines were all killed, showing what the condition of the entire field would probably have been had there been no sprays used. On the sprayed blocks,

that is, those sprayed with the two bordeaux mixtures, the vines continued to grow and set fruits.

An examination of the field on the first and second of August showed that there was an average of seventy-eight plants in the sprayed blocks, against one hundred and forty in the unsprayed blocks, which had well developed spots of the anthracnose on the petioles of the leaves and on the vines, with a total of five hundred and seventeen infected plants out of a possible nine hundred and forty-five plants in the whole field. This shows a reduction of over forty per cent. in favor of the sprayed plants. At the same time, measurements were made of the diameter of the leaf-surface of each hill that showed spots of the anthracnose. Computations made from these measurements show that there was about twice as much area infected where the plants were not sprayed. When a comparison was made of the block through th center of the field which was sprayed with normal-bordeaux and the unsprayed blocks, one on each side of it, where the condition for infection were the best in the field, there was a gain of thirty-four per cent. in the number of vines not infected with the anthracnose on the petioles of the leaves and on the vines, and a gain of thirty-two per cent. in the area of leaf-surface not infected with the anthracnose on the sprayed over the unsprayed plants, based on the condition of the unsprayed plants.

On the thirty-first of August, when I visited the field the second time, nearly all the plants in the check blocks were dead, and most of those in the block sprayed with ammoniacal-copper-carbonate were either dead or had only a few live leaves on the ends of the vines. When I visited the field for the last time on the twenty-seventh of September there were still a few plants alive in the normal-bordeaux block, while the majority of those in the soda-bordeaux block were growing and blossoming as if there had been no disease, although at this time there was an abundance of anthracnose spots on the leaves. On the block sprayed with ammoniacal-copper-carbonate and the unsprayed blocks there was scarcely a live plant. Mr. Brooks tells me that the superior flavor of the melons from the sprayed blocks, where the vines retained their leaves long enough to ripen the fruit, was very noticeable.

From the data taken of the number of plants showing the anthracnose on the petioles of the leaves and on the vines and the

area of the infected leaf-surface, it will be seen that there was considerable difference between the sprayed blocks over those that were not sprayed. When the improved quality of the watermelons is considered, in addition to the increased period of growth and the reduced amount of the anthracnose on the sprayed over the unsprayed blocks, it would seem conclusive that spraying with bordeaux mixtures, but not with ammoniacal-copper-carbonate was successful in combatting the anthracnose of the watermelon.

DESCRIPTION OF PLATES.

The drawings were outlined by means of a microscope and camera lucida, and the half-tones reproduced from photographs taken by Mr. W. E. Rumsey.

Plate I. Fig. 1.—Young watermelon, showing the effects of the anthracnose. Natural size.

Fig. 2.—Piece of watermelon rind, showing the masses of spores in the depressions caused by the anthracnose. From the same watermelon as shown in Plate II. Natural size.

Plate II. Watermelon as found in the market by Mr. F. E. Brooks, showing the effect of the anthracnose.

Plate III. The anthracnose fungus in different stages of development.

Fig. 1. *a*.—Spores as taken from watermelon, showing granular contents; *b*.—spores after being in water a short time, showing the formation of vacuoles before germinating.

Figs. 2-4.—Mycelium developing from spore (*a*).

Fig. 5.—Chlamydospore-like bodies (*a*). The color extends back from the spore-like bodies along the filament (b).

Fig. 6.—Section through a young acervulus, showing the layer of spore-bearing hyphae (*a*), setae (*b*), and parenchyma-like tissue (*c*), caused by cutting through the mass of filaments from which the hyphae develop.

Plate IV. Fig. 1. An acervulus developing in a drop culture, showing the colored sharp-pointed setae surround-

ing the hyphae which are to produce the spores.

Fig. 2.—Hypha from the center of an acervulus, showing a spore (*a*), basidum (*b*) and a portion of one of the filaments that makes up the base of the acervulus as shown in Plate III, fig. 6, (*c*).

Fig. 3.—Basidium with a spore (*a*) just beginning to form.

Fig. 4.—Basidia with spores in different stages of development.

Plate V. Fig. 1.—Pure culture of the fungus in a Petri dish of muskmelon-agar. The round light-colored spots are masses of spores.

Fig. 2.—Muskmelon seedling inoculated with spores from pure culture. The spots on the seed-leaves show the effect of the fungus.

Fig. 3.—Muskmelon seedlings inoculated with spores from a pure culture. The plants that have fallen over to one side were inoculated on the stems and resemble seedlings that have damped-off.

PLATE I.

FIG. 1. ANTHRACNOSE OF YOUNG WATERMELON. NATURAL SIZE.

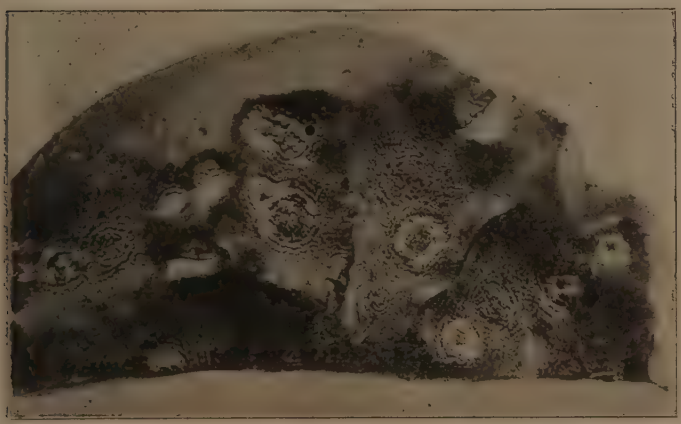

FIG. 2. CAVITIES IN RIND OF WATERMELON, SHOWING MASSES OF SPORES. NATURAL SIZE.

PLATE II.

ANTHRACNOSE OF MATURE WATERMELON. ABOUT ONE-THIRD NATURAL SIZE

PLATE III.

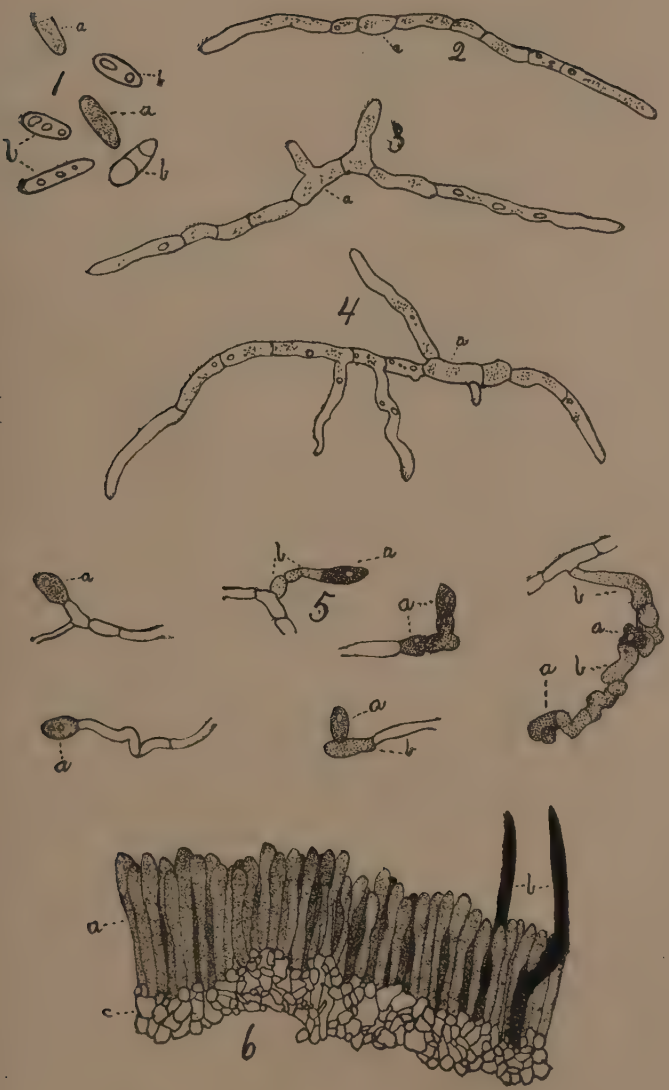

PLATE IV.

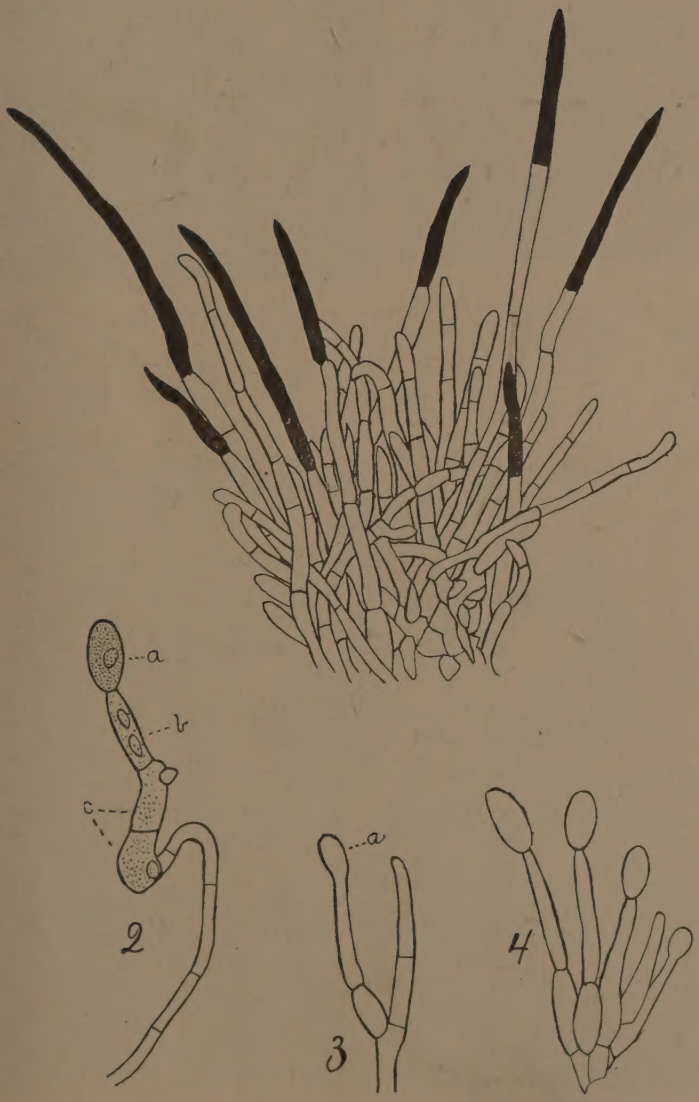

FIG. 1. PURE CULTURE OF THE ANTHRACNOSE. THE ROUND WHITE SPOTS ARE MASSES OF SPORES. NATURAL SIZE.

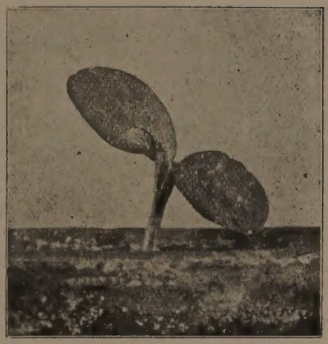

FIG. 2. SEEDLING MUSKMELON, SHOWING SPOTS PRODUCED BY THE ANTHRACNOSE. NATURAL SIZE.

FIG. 3. SEEDLING MUSKMELONS, SHOWING THE EFFECT PRODUCED BY INOCULATING WITH THE ANTHRACNOSE. NATURAL SIZE.